Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
International Bureau Seeks Comment on Recommendations Approved by World Radiocommunication Conference Advisory Committee	)	IB Docket No. 16-185 Document WAC/047 (30.10.17)

CORRECTED COMMENTS OF BROADCOM CORPORATION

Broadcom Corporation hereby comments on the Recommendations approved by the Federal Communications Commission's ("FCC" or "Commission") World Radiocommunication Conference Advisory Committee ("WAC"). Broadcom joins the numerous telecommunications and technology companies and organizations in support of IWG-2 View A on WRC-19 Agenda Item 9.1/Issue 9.1.5, which recommends no change to footnotes Nos. 5.447F and 5.450A of the International Telecommunication Union ("ITU") Radio Regulations.[1] View B would take a significant and potentially irreversible step toward ITU regulatory changes that would significantly curtail Wi-Fi operations in a large portion of the 5 GHz band—spectrum that billions of devices, and billions of consumers, depend on globally for high-speed connectivity, and which supports U.S. jobs and economic growth.

[1] Cisco Systems, Inc., Comcast, Facebook, Inc., Harris, Wiltshire & Grannis LLP, Hewlett Packard Enterprise Company, Intel Corporation, Microsoft Corporation, NCTA – The Internet & Television Association, Samsung Electronics America and Wi-Fi Alliance all supported View A during the IWG-2 process.

As a leading diversified communications semiconductor company, Broadcom has a unique interest in and understanding of the overall communications ecosystem and the various technologies used to transmit data. Broadcom is an active member of leading communications standards organizations, including the Institute of Electrical and Electronics Engineers ("IEEE"), the Third Generation Partnership Project ("3GPP"), and the Wi-Fi Alliance, and consistently plays a major role in advancing the state of the art in wireless technologies.

Wi-Fi chipsets form an important part of the wireless segment of Broadcom's business and Broadcom's chips are widely used in Wi-Fi access points and client devices. In fact, Broadcom products play an important role in enabling almost every wired or wireless communication across the globe at some point in the network. Broadcom also has deep experience in implementing Dynamic Frequency Selection (DFS), as required under FCC regulations in devices operating in the 5 GHz bands at issue, 5250–5350 MHz and 5470–5725 MHz. All of Broadcom's multiband chips (i.e., chips that support operation across the available 5 GHz range), also support the DFS bands.

Wi-Fi puts wireless communications within reach of everyone, lifting restrictions on who can provide innovative new services, and where wireless technologies can be deployed. Wi-Fi also offers extremely high speeds, with low latency, and at low cost. The current Wi-Fi standard, 802.11ac, is capable of speeds of more than 1 Gbps. The emerging version, 802.11ax, is faster still. That is how Wi-Fi already carries nearly half of global Internet traffic[2] and 80% of mobile

[2] Cisco, *Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2016–2021* fig. 23 (2017), https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/mobile-white-paper-c11-520862.html.

data,[3] using only a tiny sliver of the total mid-band spectrum that could be made available for wireless communications. For most U.S. consumers today, therefore, the broadband Internet experience *is* a Wi-Fi experience. Anything that reduces Wi-Fi speeds, or increases the cost of Wi-Fi equipment, is tantamount to reducing broadband Internet speeds, increasing broadband Internet costs, or both.

Wi-Fi plays a crucial—and expanding—role in the U.S. economy. Studies have shown that unlicensed technologies led by Wi-Fi will contribute a total of $547 billion to the U.S. economy in 2017 alone, and add approximately $50 billion to the U.S. GDP.[4] This makes unlicensed spectrum a significantly larger contributor to national GDP than the entire U.S. rail transportation industry, and nearly as large as the U.S. mining industry.[5]

An important factor in Wi-Fi's success has been international harmonization of the rules that govern unlicensed spectrum. Rules that allow nearly global access to the 2.4 GHz band and parts of the 5 GHz band have greatly reduced the cost of Wi-Fi equipment by maximizing economies of scale. The 5 GHz band is especially important—demand for 5 GHz Wi-Fi is growing rapidly, with Wi-Fi utilization having long since surpassed the capacity available in the 2.4 GHz band.

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[3] Steve Methley & William Webb, Quotient Assocs. Ltd., *Wi-Fi Spectrum Needs Study* 13 (2017), https://www.wi-fi.org/downloads-registered-guest/Wi-Fi%2BSpectrum%2BNeeds%2BStudy_0.pdf/33364.

[4] Raul Katz, Telecom Advisory Servs., LLC, *Assessment of the Future Economic Value of Unlicensed Spectrum in the United States* 4 (2014), http://wififorward.org/wp-content/uploads/2017/06/Katz-Future-Value-Unlicensed-Spectrum-final-version-1.pdf.

[5] *See* Bureau of Econ. Analysis, *Industry Data*: *Value Added by Industry* (Nov. 2, 2017), https://bea.gov/iTable/iTable.cfm?reqid=51&step=51&isuri=1&5114=a&5102=1#reqid=51&step=51&isuri=1&5114=a&5102=1.

Moreover, 5 GHz unlicensed spectrum will be at the core of the 5G ecosystem. It is widely recognized that 5G will depend on a mixture of licensed and unlicensed technologies, with Wi-Fi and other unlicensed technologies playing a key role in the network densification needed to achieve 5G speeds. As the GSM Association has noted, "future networks will rely on a combination of mainstream and alternative technologies, and use both licensed and unlicensed spectrum."[6] Similarly, emerging 5G standards developed by 3GPP identify unlicensed technologies, including Wi-Fi, as peer radio access technologies capable of providing 5G mobile connectivity without any licensed component at all. Clearly, unlicensed use of 5 GHz spectrum will only expand in the coming years.

However, referencing new frequency hopping and bistatic radar systems in footnotes Nos. 5.447F and 5.450A, as proposed by View B, could severely constrain the spectrum available for these advances, and place new limitations on spectrum available for Wi-Fi, at a time when the industry—and the Commission[7]—consensus is that significantly more unlicensed spectrum is needed, not less, in the 5 GHz band. Proponents of these radar technologies have

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6 Emeka Obiodu & Mark Giles, GSM Ass'n, *The 5G Era: Age of Boundless Connectivity and Intelligent Automation* 10 (2017), https://www.gsmaintelligence.com/research/?file=0efdd9e7b6eb1c4ad9aa5d4c0c971e62&download.

7 *Ajit Pai, FCC Chairman Bio*, FCC, https://www.fcc.gov/about/leadership/ajit-pai (last visited Oct. 2, 2017) (the Commission "must free up . . . more unlicensed spectrum for things like Wi-Fi."); *see also* Commissioner Michael O'Rielly, *A Mid-Band Spectrum Win in the Making*, FCC Blog (July 10, 2017), https://www.fcc.gov/news-events/blog/2017/07/10/mid-band-spectrum-win-making ("Study after study has shown that the U.S. is going to need multiple gigahertz of licensed and unlicensed spectrum just to keep up with current growth patterns."); Commissioner Jessica Rosenworcel, *Bringing the Connected Future to All Americans, May 11, 2012 – January 3, 2017*, FCC Blog (Dec. 30, 2016), https://www.fcc.gov/news-events/blog/2016/12/30/bringing-connected-future-all-americans-may-11-2012-%E2%80%93-january-3-2017 ("Moreover, as any wireless user can attest to, the airwaves used for Wi-Fi today are getting crowded—putting a premium on identifying additional spectrum for unlicensed growth.").

stated very clearly in the past that there is no known DFS mitigation technology that would enable today's DFS-enabled Wi-Fi chips to protect against frequency hopping or bistatic radar. Referencing updated ITU-R Recommendations with additional frequency hopping and bistatic radar in the UNII-2A and UNII-2C bands would effectively remove UNII-2A and UNII-2C as accessible bands in global markets. Limiting the availability of these key 5 GHz frequencies worldwide would frustrate chipmakers and device manufacturers' efforts to achieve global economies of scale, increasing the cost of Wi-Fi equipment in the U.S. market.

View B is being proposed by a limited number of interests, when it is not at all clear that the U.S. government has any plans to build frequency hopping or bistatic radars. These appear to be radars that other governments are considering, and have not even yet implemented. It makes little sense to threaten a vibrant sector of the U.S. economy, access to broadband by U.S. consumers, and a key part of the 5G ecosystem for other governments' future possible interests. For all of the above reasons, Broadcom urges the Commission to adopt View A of the WAC's Recommendation on Issue 9.1.5, in its reconciliation discussions with other agencies, as the U.S. government prepares for regional meetings to develop positions on WRC Issues.

Respectfully submitted,

s/Christopher Szymanski

Christopher Szymanski
Director, Product Marketing and Government Affairs

BROADCOM CORPORATION
5300 California Avenue
Irvine, CA 92617

November 9, 2017